



Mission Concept: Mars 2020

Over the past two decades, missions flown by NASA's Mars Exploration Program have shown us that Mars is a rocky, cold, and dry planet underneath a dusty, sometimes pink sky. Using a mix of detailed measurements from orbital and landed missions, scientists have discovered hints in today's Martian wasteland that the Red Planet was once an active place where volcanoes raged, meteors plowed deep craters, and flash floods rushed over the land. Together, these processes and others point to past wet conditions of sufficient longevity to support the development of microbial life.

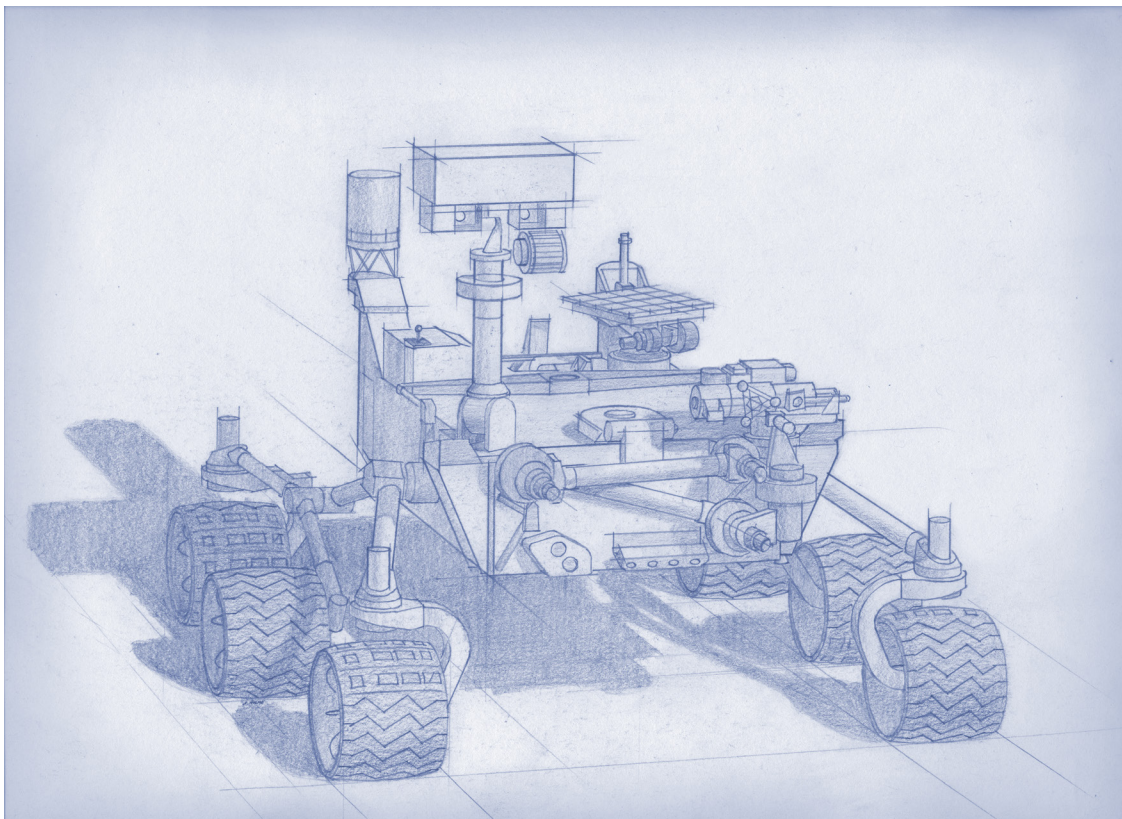
NASA's proposed Mars 2020 mission would build upon many discoveries from the Mars Curiosity rover and the

two Mars Exploration Rovers, Spirit and Opportunity, by taking the next key steps in our understanding of Mars' potential as a habitat for past or present life.

Searching for scientific clues to answer this question means delving into the planet's geologic and climate history to find out how, when, and why Mars underwent dramatic changes to become the harsh planet we observe today.

The Mars 2020 rover would be designed to seek signs of past life on Mars, collect and store a set of soil and rock samples that could be returned to Earth in the future, and test new technology to benefit future robotic and human exploration of Mars.

Proposed Mars 2020 Mission: Key Features



- Seek signs of past life
- Explore a geologically diverse landing site
- Confirm ancient habitability of site
- Make coordinated scientific measurements, down to microscopic level
- Demonstrate technology for future robotic and human exploration

Proposed Mars 2020 Mission: Main Objectives

Explore an ancient environment that, from both orbital measurements and surface data about Mars, has the potential to have supported life in the past.

Assess the ability of this Martian environment to have preserved any signs of past life (biosignatures) and search out potential evidence of these signs.

Gather a scientifically compelling and well-documented set of rock and soil samples, and assemble them into a sealed container that could be returned to Earth by a future NASA mission.

Demonstrate key technologies beneficial for future robotic and human exploration of Mars, such as some steps of the process to capture oxygen from the atmosphere of Mars, and possibly improved navigation techniques for precision landings.

Proposed Mars 2020 Mission: Key Hardware

The rover will carry seven carefully-selected instruments to conduct unprecedented science and exploration technology investigations on the Red Planet. They are:

- Mastcam-Z, an advanced camera system with panoramic and stereoscopic imaging capability with the ability to zoom. The instrument also will determine mineralogy of the Martian surface and assist with rover operations. The principal investigator is James Bell, Arizona State University in Tempe.
- SuperCam, an instrument that can provide imaging, chemical composition analysis, and mineralogy. The instrument will also be able to detect the presence of organic compounds in rocks and regolith from a distance. The principal investigator is Roger Wiens, Los Alamos National Laboratory, Los Alamos, New Mexico. This instrument also has a significant contribution from the Centre National d'Etudes Spatiales, Institut de Recherche en Astrophysique et Planétologie (CNES/IRAP) France.
- Planetary Instrument for X-ray Lithochemistry (PIXL), an X-ray fluorescence spectrometer that will also contain an imager with high resolution to determine the fine scale elemental composition of Martian surface materials. PIXL will provide capabilities that permit more detailed detection and analysis of chemical elements than ever before. The principal investigator is Abigail Allwood, NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California.
- Scanning Habitable Environments with Raman & Luminescence for Organics and Chemicals (SHERLOC), a spectrometer that will provide fine-scale imaging and uses an ultraviolet (UV) laser to determine fine-scale mineralogy and detect organic compounds. SHERLOC will be the first UV Raman spectrometer to fly to the surface of Mars and will provide complementary measurements with other instruments in the payload. The principal investigator is Luther Beegle, JPL.

- The Mars Oxygen ISRU Experiment (MOXIE), an exploration technology investigation that will produce oxygen from Martian atmospheric carbon dioxide. The principal investigator is Michael Hecht, Massachusetts Institute of Technology, Cambridge, Massachusetts.
- Mars Environmental Dynamics Analyzer (MEDA), a set of sensors that will provide measurements of temperature, wind speed and direction, pressure, relative humidity and dust size and shape. The principal investigator is Jose Rodriguez-Manfredi, Centro de Astrobiología, Instituto Nacional de Técnica Aeroespacial, Spain.
- The Radar Imager for Mars' Subsurface Experiment (RIMFAX), a ground-penetrating radar that will provide centimeter-scale resolution of the geologic structure of the subsurface. The principal investigator is Svein-Erik Hamran, the Norwegian Defence Research Establishment, Norway.
- Rover body and other major hardware (such as the cruise stage, aeroshell, and heat shield) would be near-duplicates of the systems of the Mars Science Laboratory to take maximum advantage of engineering heritage.
- The rover's baseline power source would be a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) provided by the U.S. Department of Energy, which uses the heat from the natural decay of plutonium-238 to generate electricity. Solar power options are also being considered.

Proposed Mars 2020 Mission: Timeline

- Launch in July-August 2020 from Cape Canaveral Air Force Station or NASA Kennedy Space Center, Fla., on an intermediate launch vehicle.
- Land on Mars in February 2021 at a site to be determined.
- Spend at least one Mars year (two Earth years) exploring the landing site region.

Program Management

The Mars 2020 Project is managed for NASA's Science Mission Directorate, Washington, D.C., by the Jet Propulsion Laboratory (JPL), a division of the California Institute of Technology in Pasadena, Calif.

At NASA Headquarters, George Tahu is the Mars 2020 program executive and Mitchell Schulte is program scientist. At JPL, John McNamee is the Mars 2020 project manager and Ken Farley of Caltech is project scientist.

For more information about the proposed Mars 2020 mission and NASA's Mars exploration program, visit:
mars.jpl.nasa.gov